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Using Technology to Find the Graph Characteristic of Quadratic Function

Zukhrufurrohmah

Mathematics Education

University of Muhammadiyah Malang, Indonesia

Zukhrufurrohmah@umm.ac.id

Abstract—This paper aims to describe how to use technology to find the graph characteristic of Quadratic Function. The description is based on the qualitative research method. The needed data is collected by observing teaching and learning activities while using technology to find the graph characteristic of Quadratic Function. This research method is descriptive qualitative method and the researcher is the main instrument of this research. The result of this research is description of learning activities of using technology to find the graph characteristic of Quadratic Function. In the end of the learning activities, students can find that the open up or open down graph is related to the coefficients of the Quadratic Function, the intersection of the Quadratic Function graph with X-axis is related to the determinant value of Quadratic Function, and the narrow or wide the graph will be related to the value of the quadratic coefficients.

Keywords—using technology; graph characteristic; Quadratic Function;

I. INTRODUCTION

The characteristic of teaching and learning in XXI century is the use of development of information and communication technology. This development of information and communication technology is nowadays issues of the educational planner that is how to make the best use of technology to the teaching and learning activity [1]. According to [2], says that in XXI century the national education strategy must be more creative and using technology to guide the student more active and use technology in teaching learning activity.

One of the information and communication technologies that recently use in teaching and learning activity is Smartphone. Recently, Smartphone is really like small computer that can fit in your pocket. It can run program and games, access the internet, send email and much more. There are so many application can be used freely and easy to the Smartphone. There also so many educational application that can be installed such as simple calculator, animation of the theorem, problem and the solution as exercises, or drawing the variety of graphs.

Using smartphone in teaching and learning familiarly called by mobile learning. Based on his study, [3] says that the smartphone-using class performed significantly better than the other five classes, as measured by traditional assessments in the science subject. Mobile learning as a distance learning brought great benefits to society such as continuous and situated learning support, decrease in training cost, and more rewarding

learning experience [4]. Indonesian researcher, [5] develop the mathematics application that can be installed in smartphone and used by student in learning activity. Other researcher, [6], says that the Fourier Application can help students understand the material about Fourier series anywhere everywhere. The researcher interest to using mobile application, Grapher, to find the graph characteristic of quadratic function.

The graph characteristic of quadratic function given to the senior high school students and its equivalent. But, in Vocational high school this material usually missed because the teachers have not enough time to explain for understanding to the students. To analyze the graph characteristic of quadratic function, students need to draw some graphs of quadratic functions, then compare each graph and finding the characteristic. The drawing is the important and longest process. It is take a long time and can be the boring one. The mobile application Grapher can reduce the time for drawing the graph and draw the graph more accurate. Therefore, the mobile learning can help students to analyze the graph characteristic more efficient and accurate. This using of the application also helps teachers to manage the learning activities such that students more active.

II. PURPOSE AND SIGNIFICANT OF THE STUDY

The purpose of the study was to describe how to use technology to find the graph characteristic of Quadratic Function. The main focus to observe steps of learning activities while using the Grapher to find the graph characteristic of quadratic function. The Grapher is the mobile application that can be installed freely in the Smartphone. The study finding can help teachers to manage learning activities while using technology as this research as reference, manage the weakness that appears while learning and planning better learning activities for next material.

III. REVIEW OF LITERATURE

Quadratic Function material is given to first grade student in senior or vocational high school. These material have the same standard competence between Senior High School and Vocational High School in 2013 Curriculum (K-13), but the large number of Vocational high School students difficult to draw the graph of quadratic function. They feel difficult to draw the quadratic function however they must analyze some quadratic function to find the graph characteristics of quadratic function. K-13 require students to be an active learners. Such

that they must find the concept that they learned and the teachers facilitate and guide the students to find the concept by her/his self. Beside require the teachers and students role, K-13 also require the using of technology information to help the teaching and learning more active [2]. Using technology to teaching and learning activities have some condition to prepare such that the technology can be used maximal.

A. Mobile Application Technology for Teaching and Learning

The use of technology is start to educational sector since the beginning of 21 Century. Starting from Over Head Projector (OHP) that used to project the small object such that can be seen by whole class. In line with technology growth, this OHP is replaced by LCD Projector that not only can project the image or data but also project the video. These LCD Projector is used together with another technology development, laptop. Nowadays, laptop as personal computer that can be easily moved and used in variety location is competed with Smartphone. People interact almost all day with Smartphone. In 2016, 65,2 million Indonesian people had their own Smartphone and predict become 74,9 million in the end of 2017 [7]. This technology development will be came education challenge in globalization era [8].

The researchers in many countries doing much researches to use technology development to education sector. The mobile technology, Smartphone, to teaching and learning is more favorite as a research topic. Smartphone can facilitate students to study anywhere and anytime based on the students mood or condition [3], [4], [6], because it's right in their palm of students hands. The learning activities using technology increase the interaction students in class and enhance students thinking [9], [10], [11], [12]. Research [13] says that online and mobile learning application motivated the students, making mathematics course more enjoyable and interactive that the ordinary teaching practice. Using technology to support mathematics teaching and learning must count some aspect that are: 1) user must not afraid of using technology on learning and teaching mathematics, 2) teachers and students must have enough knowledge and competence to operate the technology such that technology do not be a master [14].

B. Using Grapher to Sketch the Graph of Quadratic Function

Grapher is mobile application that can show the draw of function. This mobile application is open source program such that user can freely install without pay a tax to developer. User can install Grapher by downloading first in Google Play. These study choose Grapher than another mobile application because it is the simplest application.

The step to sketch the graph of quadratic function using Grapher are:

- Setting the function such that its form $y = f(x)$ to setting that the input is the function with variable x.
- Input the quadratic function that will be draw
- See the result in Cartesian Coordinate

- When you want to draw another quadratic function without erase the previous graph, choose the + sign then input the function.



Fig. 1. The Result of Graph of Quadratic Function

C. Teacher Position in Technology Classes

The characteristic of these 21 Century is development of technology and information. These technology and information development also influence the education sector. One of the characteristic in 21 Century is the knowledge that be connected each other without blocked space and time because of the technology development [2]. Beside technology characteristic, Indonesia also design the new curriculum, said 2013 Curriculum (K13) that nowadays education requires to students centered learning. One of the learning method that engage students to be an active learner is constructivist perspective that believe learning is constructed by the learners through experience [15]. Moreover [12] says that construction of knowledge is a dynamic process that requires the active engagement of the learners who will be responsible for ones learning while the teacher only create an effective learning environment. This student centered learning is designed by teachers as a facilitator [16].

Using of the technology development is one of the strategy to reach the aim of K13 [2]. Collaborating the constructivism learning and technology development can attend the new class environment. The technology development in learning process can be role as a master if user's knowledge and competence are limited to a narrow range of operation, technology as a servant if used without changing the nature of classroom activities, as a partner if used to explore difference perspective or mediate mathematics discussion [14]. Technology in constructivism class can serve as coaches by locating the problem and allowing for as much practice and help as necessary to accomplish the task [12]. Simply, teacher have to make sure that they are using technology as a part of approaches that involve student's activities [12]. In the other word, by using technology teachers must prepare the instruction learning to give more opportunity students to explore their knowledge, active in learning process, meet difference level and styles, and broaden the learning resources.

IV. METHODOLOGY

A. Research and Design

The purpose of the study was to describe the steps of students activities learning while using technology, mobile application Grapher, to find the graph characteristic of quadratic function. The study is qualitative descriptive research. A qualitative approach was used to gather and analyze the data from observation the learning activities and interview the observer. The observer fill the score in the observation form that suitable condition in learning activities while using mobile application, Grapher, to find the graph characteristic of quadratic function. The interview conduct after the observation to get more information from the observer. The finding of this study have potential of helping mathematics educator or teachers understand the benefit of the mobile application in learning mathematics.

B. Participants

The study gathers qualitative data from software engineering and electrical classes in Vocational High School. Students works in group and each group consist of 3 or 4 members. There are eight groups in class, but only five groups that give the good attendance while learning activities using Grapher Application to find the graph characteristic of Quadratic Function. There over, the data analyze will be focused on the five groups that have a complete attendance. There are two observers, include the teacher as the observer, while learning activities.

V. DATA COLLECTIONS

The data were collected through observation, interview, and students' questionnaire. The observation form consist of 12 indicators to measure the teaching and learning activities suit the step of using Grapher application to find the graph characteristic of quadratic function. The interview was held after the class activities to gather more information that not covered in the 12 indicators. The students questionnaire conduct to gather information and impression from students while using Grapher Application to find the graph characteristic of Quadratic Function.

VI. DATA ANALYSIS

Through the observation data, I analyze learning activities of using Grapher to find the graph characteristic of quadratic function such that I can find the efficient steps to find the graph characteristic using Grapher. The information of the efficient steps also gather from interview data. The data analyze based on the observation form are:

1. Average the score of each indicator that written in the observation form
2. Exploring the reason of high and low score with interview the observer
3. Conclude the steps of learning activities from score of the indicator and the interview result.

The students questioner are used to gather information and responds from students that use the Grapher to find the graph

characteristic of quadratic function. The average score of each indicator

VII. FINDINGS AND DISCUSSION

I design the learning steps that refer to guided discovery model, one of constructivism learning method, using Grapher to find the graph characteristic of quadratic function. The steps learning are apply to examine the effectiveness of steps learning to find the graph characteristic of quadratic function while using Grapher. The steps are:

- 1) Recall the previous material
- 2) Ask students to sketches some graph based of the given quadratic functions by using Grapher then observe the result
- 3) Ask students to guess the relation between the graph and the corresponding quadratic function
- 4) Ask Students to check their guess by making another sketches of some quadratic functions by using Grapher
- 5) Conclude the relation between the sketch and the corresponding quadratic function.

Based on the observation data, the students give good response in the first step because it helps students to remind the previous material that had been received and guide students to know the material that will be learn. The second steps have some weakness because students confused with word 'sketch' such that students ask to teachers what to do. Although the destination of the learning activities had been written in the Students worksheet, students did not read it such that they confused and ask the teacher. Based on the observation, teachers needs to give the additional question such that students read it before do the second step. The 'sketch' means to move the graph that shown in Grapher to their paper. The sketch result shown in Figure 2.

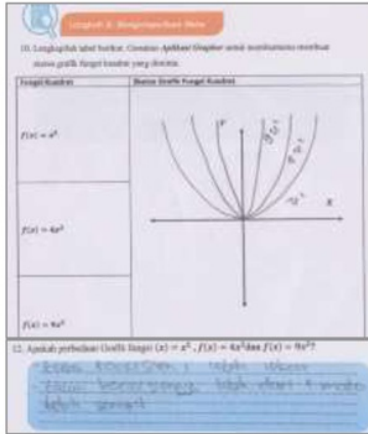


Fig. 2. The Second Step of the Learning Process

The third step is difficult to students since students is not used to make a conjecture. The third step asks students to write their conjecture after observing the result of the graph and the corresponding quadratic function. Based on the observation teaching activities teacher not need to give the additional question to guide students. Some student's conjecture are showed in Figure 3.

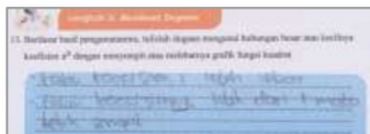


Fig. 3. The Second Step of the Learning Process

The fourth steps is done by sketch another graph of quadratic functions. The sketches are drawn based on the quadratic function graph that shown in Grapher Application. Then students analyze their conjecture whether it suit the new quadratic functions or not. The Picture 4 show the students result of fourth step. In this step, teacher need to guide students if their conjecture is wrong. Teachers can choose a specific quadratic function to students such that students can clarify their conjecture in step fourth. Based on the observation in learning activities, students are helped to sketch the quadratic function graph by using Grapher.

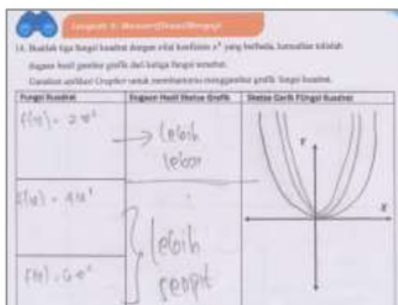


Fig. 4. The Third Step of the Learning Process

Students conclude the graph characteristic of quadratic function based on the activities that had been done. Students did not feel difficult in this step.

Based on the learning activities that had been observed, the steps of learning process by using Grapher to find the graph characteristic of quadratic function are: recall the previous material, then sketch the graph based on the quadratic function that shown from the Grapher, after that write the conjecture consider the result of the sketches, then examine the conjecture by trying another quadratic function, and the last step is conclude the graph characteristic based on the activities before. Another finding from this learning activities are:

- 1) There a good responses from students while using mobile application to learning activities. Some students ask the teacher about another application that can help them to learn about machines.
- 2) Using Grapher to show the draw of quadratic function is more efficient rather than draw the graph manually.
- 3) If the students not familiar with the application, teacher must inform them to try it by their self, such that they master the application before learning activities.
- 4) Students is not used to describe their opinion such that they difficult to write the conjecture and doubt to write their conclusion.

VIII. CONCLUSION

Using technology in class, nowadays, is become strategy that must be considered by teachers. This technology can be used as a partner of the students to learning new concept such that students become an active learning. Using technology application, Grapher, to find the graph characteristic of quadratic function can be done by steps: 1) review the previous material, 2) sketch the graph of given function and analyze the relation of the sketches, 3) write the conjecture based on the sketch of the graph of the corresponding quadratic function, 4) examine the conjecture by sketch another quadratic function, and 5) conclude the graph characteristic based on the examine step.

Based on this study, teacher must notice some matter while using technology in their class activities. That are:

- 1) Students and teacher must be mastered the technology before used them in their class activities to optimize the technology.
- 2) Teacher needs to motivate students to use technology to add new knowledge in education sector.
- 3) While using technology, teachers must guide the students clearly in each step. There over teacher needs Students Worksheet or Students Activities Guide to guide students find the material.

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